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09/411,143	10/04/1999	THOMAS C.K. YUEN	SRSLABS.257A	7907

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EXAMINER
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/411,143	Applicant(s) YUEN ET AL.	
	Examiner Tony M Jacobson	Art Unit 2644	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _14 June 2004_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-36_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-36_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _04 October 1999_ is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _06/24/04_.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities: The specification at page 24, lines 21-23, the specification is not consistent with Figure 6C, according to the common meanings of the terms "pass-band" and "stop-band". As Applicants are likely aware, in referring to a filter response or transfer function, the term "stop-band" is generally used to indicate a band of frequencies where components of an input signal are significantly attenuated in the corresponding output signal (they are "stopped"), while "pass-band" generally refers to a band of frequencies where components of an input signal are not significantly attenuated (they are "passed"). In graphically depicting filter responses, it is conventional to portray the amplitude response on a decibel (dB) scale, as indicated by the amplitude axis labels of Applicant's Figs. 6A-6D. A decibel amplitude measure typically indicates (on a logarithmic scale) the ratio of a linear measure to some reference level, and in discussing filter responses, one typically refers to a "gain", or equivalently, an "amplitude response", which is a ratio of the output signal amplitude to the input signal amplitude, and may be defined as $A_{dB} = 20 \cdot \log_{10}(A_{in}/A_{out})$. The point being made here is that a filter response level of "0 dB" indicates that an input signal is passed with unity gain (neither attenuated nor amplified), rather than indicating that the actual level is zero in the linear sense. Positive decibel response levels indicate relative gain, while negative decibel response levels indicate relative attenuation. Thus, in Applicants' Fig. 6C, the band of frequencies below about 1 kHz is a pass-band, since the signals are

passed with substantially unity (0-dB) gain, and the band of frequencies above about 10 kHz is a stop-band, since the signals are significantly attenuated. Applicants accurately describe the band of frequencies between about 1 kHz and 10 kHz as a transition band.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-4 and 6-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iwamatsu (US 5,999,630) in view of Short et al. (US 4,739,514).

4. Regarding claims 1, 6, and 20, Iwamatsu discloses in Fig. 5, a sound enhancement (audio correction) system (18) comprising: an image correction (sound enhancement) module (38) configured to correct a vertical image (perceived height) of sound when said sound is reproduced by a plurality of loudspeakers (an apparent sound stage produced by a plurality of loudspeakers) (column 5, line 34 –column 6, line 11), said image correction module altering said sound as a first function of frequency over a first frequency range and altering said sound as a second function over a second frequency range, wherein said first function of frequency is independent of said second function of frequency; (the image correction module [comprising two independent notch

filters 38 in Fig. 5] alters said sound as a first function of frequency [as shown generally in Fig. 7B] over a first frequency range [the range of frequencies illustrated in Fig. 7B] and alters said sound as a second function of frequency [also as shown generally in Fig. 7B] over a second frequency range [equal to the first frequency range], wherein said first function of frequency is independent of said second function of frequency [because the notch frequency "Nt" of each notch filter 38 is independently set by parameter calculation unit 62 according to independent sets of positional parameters r, θ, and φ for each signal channel, as illustrated in Fig. 5 and described at column 7, lines 51-64]); and an image (sound) enhancement module (64) configured to spectrally shape difference information associated with said sound to enhance (correct) a horizontal image (perceived width) of the apparent sound stage (produced by the loudspeakers) (column 1, lines 5-54) (As should be apparent to one of ordinary skill in the art, summing a slightly delayed version of a given channel signal with the opposite channel signal in a stereophonic signal pair inherently spectrally shapes difference information associated with the sound represented by the stereophonic signal pair. (Iwamatsu discloses at column 8, lines 40-42 that the time delay "d" in the crosstalk cancellation network 64 of Fig. 10 is about 0.6 milliseconds; and when such a delayed signal is cross-coupled to the opposite channel with a negative gain as illustrated, a partial comb-filter modification of difference information will inherently occur, producing dips at odd multiples of 833 Hz and peaks at even multiples of 833 Hz in the frequency response of the network to difference information). Iwamatsu does not disclose a bass (sound) enhancement module configured to enhance a perceived bass response of the

sound (of the loudspeakers) when the sound is reproduced by the plurality of loudspeakers, said bass enhancement module configured to produce a perception of low-frequency sound when sound is reproduced by said plurality of loudspeakers. Short et al. discloses in Figs. 1 and 3 (bass) sound enhancement modules configured to enhance a bass response (and thus a perceived bass response) of sound when said sound is reproduced by one or a plurality of loudspeakers (column 2, line 43 –column 3, line 49; Fig. 2), said bass enhancement module configured to produce a perception of low-frequency sound when said sound is reproduced by said one or more loudspeakers. (According to the general description and as illustrated in Fig. 2, the bass enhancement system (module) is configured to reproduce low-frequency sound; thus, if a hearing-enabled person listens to the sound reproduced by the system, a perception of low-frequency sound will also be produced in the person.) It was well known in the audio signal processing art at the time the present invention was made to combine various known audio enhancement techniques and systems of the prior art in order to simultaneously enhance or improve multiple aspects of the sound produced. It would have been obvious to one of ordinary skill in the art at the time the present invention was made to combine the bass enhancement module of Short et al. with the system of Iwamatsu in order to provide a further enhanced acoustic output signal. The system so modified performs the method of claim 20 in normal use.

5. Regarding claims 2 and 3, absent any teaching to the contrary, it would have been obvious to one of ordinary skill in the art at the time the present invention was made to arrange the modules in the system of Iwamatsu, modified according to the teachings of Short et al. as described above regarding claim 1, in any convenient or logical manner, placing the vertical image correction module either before or after the bass enhancement module as an obvious design choice.

6. Regarding claim 4, Iwamatsu illustrates in Fig. 5 that correction provided by the image correction module (38) precedes image enhancement provided by the image enhancement module (64). As it is common in such systems to perform crosstalk cancellation as performed by "image enhancement module" 64 as a final step, prior to power amplification and loudspeaker reproduction (e.g., so that an equivalent binaural signal is available prior to the crosstalk canceller for headphone reproduction), it would have been obvious to one of ordinary skill in the art at the time the present invention was made to maintain the same relationship in the system modified to include the bass enhancement module of Short et al.

7. Regarding claims 7 and 21, although Applicant's disclosure has not clearly defined a difference between a perceived height of an apparent soundstage and a perceived vertical location of an apparent soundstage, and "height", as recited in claim 6, can generally mean either vertical location or vertical size, by focusing the apparent

vertical location of a sound image (stage) to a certain location as described at column 5, line 34 –column 6, line 11, the system of Iwamatsu inherently corrects (changes) a perceived vertical size ("height") and a perceived vertical location of an apparent sound stage produced by the plurality of loudspeakers (as heard by a listener).

8. Regarding claims 8 and 22, Iwamatsu discloses in Fig. 5 that the height correction (first) module comprises a left-channel filter (38-upper) to filter sounds in a left signal channel (SL) and a right-channel filter (38-lower) configured to filter sounds in a right signal channel (SR).

9. Regarding claims 9 and 23, Iwamatsu discloses at column 6, lines 5-12 that the left- and right-channel filters (38) are configured to filter (adjust frequency components of) the left and right channels in accordance with a variation in frequency response of a human auditory system as a function of vertical position of a sound source.

10. Regarding claims 10 and 24, Fig. 7B shows that the left- and right-channel filters (38) in the system of Iwamatsu are configured to emphasize lower frequencies (those lower than frequency "Nt") relative to higher frequencies (those proximate to frequency "Nt"), as broadly as claimed.

11. Regarding claims 11 and 25, in the sound enhancement system of Iwamatsu, modified according to the teachings of Short et al., the perceived bass correction ("second") module is configured to emphasize portions of lower frequencies relative to higher frequencies, as taught by Short et al. at column 1, lines 20-56 and column 4, lines 32-43 and illustrated in Fig. 2.

12. Regarding claims 12 and 26, in the sound enhancement system of Iwamatsu, modified according to the teachings of Fig. 3 of Short et al., the second sound enhancement module (Fig. 3 of Short et al.) is configured to receive a plurality (two) of input signals (11L and 11R) (which may also be referred to collectively as "a signal") and to emphasize common-mode portions of lower frequencies of the input signal(s) relative to higher frequencies of said input signal(s) (inherently, due to summer 17 and low-frequency bandpass filter 16).

13. Regarding claims 13 and 27, the sound enhancement module of Fig. 3 of Short et al. comprises a first combiner (17) configured to combine a[t] least a portion of a left channel signal with at least a portion of a right channel signal to produce a combined signal; a filter (18) configured to select a portion of said combined signal to produce a filtered signal; a variable gain module (15) configured to adjust (amplify) said filtered signal in response to an envelope of said filtered signal (the inherent mode of operation of a compressor) to produce a bass enhancement signal; a second combiner (14L)

configured to combine at least a portion of said bass enhancement signal with said left channel signal; and a third combiner (14R) configured to combine at least a portion of said bass enhancement signal with said right channel signal.

14. Regarding claims 14, 15, 28, and 29, Short et al. disclose generally that the variable gain module comprises a compressor (which compresses the filtered signal during an attack time period); and at column 3, lines 50-52 that the compression ratio might be set to any other value besides the 2:1 ratio of the preferred embodiment in order to realize certain desired equalization curves. It would have been obvious to one of ordinary skill in the art to set the compression ratio to any other value, including values less than 1:1, such as 1:2, which corresponds to expansion (in which the filtered signal would be expanded during a decay time period), in order to provide a further enhanced bass output from the system.

15. Regarding claims 16, 17, 30, and 31, the perceived width correction ("third") module 64 in the system of Iwamatsu inherently receives input signals comprising a left-channel input and a right-channel input, identifies a common-mode portion, provides a common-mode behavior in response to common-mode portions of the input signals, identifies a differential-mode portion, and provides a differential-mode behavior in response to differential-mode portions of the input signals; and these respective behaviors are inherently due to providing a common-mode transfer function and a differential-mode transfer function. (As described above regarding claims 1, 6, and 20,

the crosstalk canceling network 64 of Fig. 10 of Iwamatsu will inherently [according to the examiner's analysis of the network] apply a differential-mode transfer function to difference information in the input signal pair, that is a comb-filter response plus a constant level offset, having dips at odd multiples of a frequency of approximately 833 Hz and peaks at even multiples of about 833 Hz. Further analysis reveals that a common-mode transfer function is applied to common-mode portions of the signal pair, that is complimentary in that peaks occur at odd multiples of 833 Hz, while dips occur at even multiples of 833 Hz.)

16. Regarding claims 18, 19, 32, and 33, although Iwamatsu does not directly disclose the differential-mode transfer function frequency characteristic of the perceived width correction module (64) in the system, analysis of the block diagram shown in Fig. 10, as described at column 7, line 65 –column 8, line 53, indicates that for very low frequency differential-mode (equal and opposite) input signals the signal level at either output will be slightly greater than the level of the corresponding input signal since the 1.2-ms delayed signal (column 8, lines 40-45) fed back within a given channel will be substantially in phase with the input signal and the crosstalk canceling signal from the opposite channel will also be substantially in phase, since it is initially of opposite phase, delayed slightly to remain of substantially opposite phase, then inverted at element 84 or 88. As the frequency of the differential-mode input signal is increased, a point will be reached (833 Hz) where the delayed signals become of opposite phase with the input signal and the output signal will be at a local minimum level. As the differential-mode

input signal frequency is further increased, the delayed signals will again become in phase with the input signal and the output will reach a local maximum (at 1.67 kHz). Additional peaks and dips will occur in the differential-mode transfer function frequency characteristic as the input frequency is further increased, with peaks occurring at each even multiple of 833 Hz and dips occurring at each odd multiple of 833 Hz. Thus, the differential-mode transfer function emphasizes lower frequencies (those far below 833 Hz) relative to higher frequencies (those around 833 Hz) and the differential-mode transfer function is configured to provide a first de-emphasis for frequency components in a first frequency band (around 833 Hz), provide a second de-emphasis for frequency components in a second frequency band (around 1.67 kHz), provide a third de-emphasis for frequency components in a third frequency band (around 2.50 kHz), and provide a fourth de-emphasis for frequency components in a fourth frequency band (such as 3.33 kHz), said first frequency band lower than said second frequency band, said second frequency band lower than said third frequency band, and said third frequency band lower than said fourth frequency band, said second de-emphasis value and fourth de-emphasis value less than said first de-emphasis value and said third de-emphasis value.

17. Regarding claims 34-36, the system of Iwamatsu, modified according to the teachings of Short et al. as described above regarding claims 1 and 6, can be alternatively described according to the limitations recited in these claims without further modification; therefore, the claims are unpatentable by the same reasoning.

18. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lendaro et al. (US 5,208,493) in view of Petroff (US 5,400,405).

19. Regarding claim 5, Lendaro et al. discloses in Fig. 2, a prior art stereo audio image enhancement system comprising at least two audio signals (L and R), said audio signals having common-mode information which is common to said audio signals and differential information which is not common to said audio signals (inherent characteristics of a stereo audio signal pair); a first amplifier (11) in communication with one of said audio signals (L), said first amplifier having an inverting input (17) and a non-inverting input (13); a second amplifier (12) in communication with one of said audio signals (R), said second amplifier having an inverting input (20) and a non-inverting input (14); a "second" filter (24 in combination with 25) in communication with said inverting input (17) of said first amplifier (11) and said inverting input (20) of said second amplifier (12), said second filter configured to modify a "second" set of frequencies (inherently); a "third" filter (16 in combination with 27L) in communication with said inverting input (17) of said first amplifier (11) and an output (15) of said first

amplifier, said "third" filter configured to modify a "third" set of frequencies (inherently), wherein said "second" and "third" sets of frequencies are combined to create a first enhanced output signal (V_3); and a "fourth" filter (19 in combination with 27R) in communication with said inverting input (20) of said second amplifier (12) and an output (18) of said second amplifier, said "fourth" filter configured to modify a "fourth" set of frequencies (inherently), wherein said "second", and "fourth" sets of frequencies are combined to create a second enhanced output signal (see column 2, line 4 –column 3, line 28). (The quoted terms "second", "third", and "fourth" as used in this paragraph are intended to refer to elements by name, not to indicate a count, in order to make clear the correlation to Applicants claimed elements.) Lendaro et al. does not disclose a "first" filter in communication with the non-inverting input of the first amplifier and the non-inverting input of the second amplifier, said "first" filter configured to modify a "first" set of frequencies in the differential information. As described at column 2, line 64 – column 3, line 2, the overall effect of the system (in an active mode of operation) is to enhance the differential information contained in the two input signals beginning from very little enhancement at low frequencies, increasing enhancement from about 150 Hz or 200 Hz, full enhancement from about 1 kHz to 3 kHz, then decreasing enhancement to virtually zero enhancement above 5 kHz. Petroff discloses in Fig. 1, a similar image enhancement system in which broadband differential information is enhanced due to resistors (R4 and R5) coupling between the inverting inputs of equivalent first and second amplifiers (14L and 14R). Petroff also includes a filter, formed by resistors R1, R2, R3, and capacitor C1, in communication with the non-inverting inputs of the first and

second amplifiers, that provides high-frequency positive-polarity cross coupling between the two input signal channels. Petroff discloses at column 4, lines 28-38 that the high-frequency positive-polarity cross coupling acts to increase the common-mode content (inherently decreasing the differential content) of the two channels in the high-frequency range, in effect converging to a degree the high-frequency imaging toward a central perceived point for enhanced localization. It would have been obvious to one of ordinary skill in the art at the time the present invention was made to include the high-frequency positive-polarity cross coupling filter of Petroff in the system of Lendaro et al. (which would be equivalent to the "first" filter in communication with the non-inverting input of the first amplifier and the non-inverting input of the second amplifier, said "first" filter configured to modify a "first" set of frequencies in the differential information, as recited in Applicant's claim 5) in order to further enhance the stereo image by enhancing the high-frequency localization. Since the image enhancement system of Lendaro et al. will inherently reproduce low-frequency sound when the output signals are reproduced by a speaker system (assuming low-frequency components are present in the input signal, as is common in stereophonic audio signals), it will also inherently produce a perception of low-frequency sound in a hearing-enabled person listening thereto.

Response to Arguments

20. Applicant's arguments filed 14 June 2004 have been fully considered but they are not persuasive.

21. As indicated in the rejections above, the limitations added to the claims (the image correction module that alters the sound as a first function of frequency over a first frequency range and alters the sound as a second function of frequency over a second frequency range to correct a perceived vertical image of the sound when the sound is reproduced by loudspeakers, wherein the first function of frequency is independent of the second function of frequency; a bass enhancement module that produces a perception of low-frequency sound when the sound is reproduced by the loudspeakers; and an image enhancement module that spectrally shapes difference information associated with the sound when the sound is reproduced by loudspeakers) are present in the references cited in the previous rejections.

22. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., "the perception of low-frequencies to a listener **when the speaker system cannot adequately reproduce the low-frequency sound**" [emphasis added]) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification,

limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tony M Jacobson whose telephone number is 703-305-5532. The examiner can normally be reached on M-F 11:00-7:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Forester W Isen can be reached on 703-305-4386. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

tmj
September 30, 2004

XU MEI
PRIMARY EXAMINER